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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,596	04/21/2004	Ki-yeon Park	5649-1286	5520
20792 7590 07/25/2008 MYERS BIGEL, SIBLEY & SAJOVEC PO BOX 37428 RALEIGH, NC 27627				
EXAMINER				
NADAV, ORI				
ART UNIT		PAPER NUMBER		
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07/25/2008		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/828,596

**Applicant(s)**

PARK ET AL.

**Examiner**

Ori Nadav

**Art Unit**

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**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 May 2008.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 4-69 is/are pending in the application.  
4a) Of the above claim(s) 7-10 and 16-69 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1, 4-6 and 11-15 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO/SB-08)  
Paper No(s)/Mail Date \_\_\_\_\_  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 4-6 and 11-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claimed limitation of "a metal oxide thin dielectric film", as recited in amended claim 1, is unclear as to whether said metal oxide is the same metal oxide element recited in line 6 of the claim or a different element. It is further unclear how the two metal oxide elements recited in lines 3 and 6 of the claim are structurally related to the metal oxide element recited in line 1 of the claim.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4-6 and 11-15, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Lim et al. (2003/0040196) in view of Li et al. (2005/0151210).

Lim et al. teach in figure 5C and related text a method of forming a metal thin film, comprising:

forming an oxygen-deficient metal oxide dielectric film 33 comprising  $\text{La}_2\text{O}_3$ , on a semiconductor substrate by atomic layer deposition (ALD, paragraph [0020]) using a lanthanum containing compound (paragraph [0067]);

and

forming a metal oxide dielectric film 34 on the oxygen-deficient metal oxide film by ALD using a lanthanum containing compound and an oxidizing agent.

Lim et al. do not teach forming an oxygen-deficient metal oxide film comprising  $\text{La}_2\text{O}_x$  wherein  $0 < x < 3$ .

Li et al. teach in paragraph [0031] lanthanum oxide having oxygen deficiency.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form Lim et al.'s lanthanum oxide having oxygen deficiency in order to improve the device characteristics.

The combination is motivated by the teachings of Li et al. who point out the advantages of using the disclosed impurity species (i.e., lanthanum oxide having oxygen deficiency).

Regarding claims 5, 12-13 and 15, Lim et al. teach:

(a) feeding the lanthanum containing compound onto the semiconductor substrate to form an adsorbed layer of the lanthanum containing compound;

(b) removing a byproduct of (a) by means of purge; and

(c) optionally repeating (a) and (b) until the oxygen-deficient metal oxide film with a predetermined thickness is formed, and

annealing the oxygen-deficient metal oxide film, wherein the annealing is carried out after forming the oxygen-deficient metal oxide film or after forming the metal oxide film,

wherein the annealing is carried out under an atmosphere of a gas selected from the group consisting of O<sub>2</sub>, N<sub>2</sub>, and O<sub>3</sub>, or combinations thereof, or under a vacuum atmosphere.

Regarding claims 4, 6, 11 and 14, Lim et al., do not explicitly state that the first reactant is selected from the group consisting of various tris or combinations thereof, the oxygen-deficient metal oxide film has a thickness in a range of about 5Å to about 30Å, wherein the method is carried out at a temperature in a range of about 200°C to about 350°C, and wherein the annealing is carried out at a temperature in a range of about 300°C to about 800°C.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a first reactant selected from the group consisting of various tris or combinations thereof, the oxygen-deficient metal oxide film has a thickness in a

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range of about 5A to about 30A, wherein the method is carried out at a temperature in a range of about 200°C to about 350°C, and wherein the annealing is carried out at a temperature in a range of about 300°C to about 800°C in prior art's device in order to form the device, as taught by prior art, using conventional processing temperatures, thicknesses and materials.

### ***Response to Arguments***

Applicant argues that Lim teaches away from such an oxygen deficient metal oxide film by stressing the importance of using an oxidizing agent when forming its metal oxide films.

Lim et al. teach in paragraph [0067] that "the reaction gas may include oxygen radical or ozon". Therefore, Lim et al. do not stress the importance of using an oxidizing agent when forming its metal oxide films. Furthermore, the method disclosed by Lim et al. does not teach away from using an oxygen deficient metal oxide film.

Applicant argues that "Lim only describes stacking metal oxide films, wherein one metal oxide film is comprised of one metal M1 and the other metal oxide film is comprised of a different metal M2. M1 and M2 are explicitly stated to be two different metals, and Lim provides no motivation to use the same metal as M1 and M2".

It is unclear to the examiner why Lim et al. is required to use the same metal as M1 and M2.

Applicant argues that the combination of Lim and Li is inappropriate, because Li teaches an oxygen-deficient lanthanum as an impurity species doped into a conductive oxide and as such provides no motivation to include such a compound in the dielectric metal oxide film of Lim.

Although Li et al. use an oxygen-deficient lanthanum as an impurity species doped into a conductive oxide, Li et al. explicitly state that the impurity species is "an insulator material" (see paragraph [0031], lines 1-2). Therefore, an artisan will be motivated to use the insulating material impurity species in the dielectric metal oxide film of Lim et al.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne Gurley can be reached on 571-272-4670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

O.N.  
7/26/2008

/ORI NADAV/  
PRIMARY EXAMINER  
TECHNOLOGY CENTER 2800